THE ALSCO CAMEROON HERPETOLOGICAL EXPEDITION 1998: THE SAMPLING OF A MOUNTAIN RAINFOREST

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Abstract: A herpetological survey of Mt Nlonako, Cameroon, was conducted in November-December 1998. Sampling techniques such as hand capture, glue traps, drift fence / pitfall traps and quadrat sampling were applied. Quantitative and nonquantitative data were gathered. Hand capture and quadrat sampling proved to be the most effective approaches. A total of 40 amphibian and 41 reptilian species were found. In the quadrats amphibians dominated the samples with 80% of all species. Arthroleptidae and Ranidae accounted for 60% of all species. A specimen abundance of 24.1 specimens per 100 m² was found. This exceeds published numbers for rainforests in Borneo, Costa Rica, Panama and previously for Cameroon.

Key words: Cameroon, herpetofauna, quadrat method, drift fence, glue traps, relative specimen abundance, species diversity

Introduction

In November-December 1998 a survey of the herpetofauna of Mt Nlonako, Cameroon (fig.1), was conducted as part of a large scale nature conservation project. Systematic surveys of Cameroon's herpetofauna are urgently needed to obtain information on species distribution and habitat requirements. Such information is vital for successful conservation management and is a keystone for further programs to monitor populations and obtain data on population shifts. Sound data on local population dynamics can be used comparatively and aid in the recognition of potentially endangered systems. Until this study very little was known about the herpetofauna of the Mt Nlonako region. Neighbouring mountain ranges, such as Mt Kupe, were herpetologically surveyed recently (Euskirchen 1998, Schmitz 1998).

Materials and Methods

The survey site is located in southwestern Cameroon, east of Mt Kupe and the Manenguba mountains, in the vicinity of Nkongsamba (fig.1). This forest area also adjoins the remote villages of Nguengue and Eyimba. The site's coordinates are 4°52-55'N and 9°57-59'E (Garmin® GPS 12). The altitude covered ranges from 700 m at Eyimba to a 1600 m mountain peak. The vegetation consists of primary and secondary montane tropical rainforest. Mt Nlonako forests are threatened by clear-cutting for plantations. In-forest disturbance includes hunting and trapping.

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Fig.1: Map of the southwestern Cameroon highlands (revised after Eisentraut 1973).

Many snares and pitfall traps were encountered during our study. However, this area remains species rich; large mammals such as elephants and chimpanzees are still reported. The survey was conducted between the 23th November and 7th December 1998; this is the beginning of the dry season (Müller 1996).

Temperature and relative humidity data were collected by using Hobo® Pro Series Temp + RH dataloggers at three different elevations (700 m, 1200 m, 1600 m). Dataloggers were positioned in the shade on tree trunks at two meters above the ground. Temperatures were recorded every minute for the duration of the study and ranged over 20-27°C at 700 m, 16-25°C at 1200 m and 16-23°C at 1600 m.

Specimens were collected by hand captures, glue traps, drift fence/pitfall traps and quadrat sampling. Hand capture was executed by both scientific staff and local villagers. A total of 42 glue traps (Victor® mouse glue traps) were arranged in an approximately 1 km transect extending from the centre of a plantation into the depths of the forest. The traps were set in pairs at a height of 50 cm and 150 cm on trees of varying diameter. A total of four drift fence-pitfall trap lines were installed in four different habitats (Corn 1994). Drift fences were erected in a Y-shape with each arm of the Y extending 5 m. At the end of each arm and in the centre a 20 l bucket was buried as a pitfall trap. Ten 8 x 8 m (64 m^2) quadrat plots were sampled (Jaeger & Inger 1994). Areas were marked and a 1 m perimeter was cleared around the plot before sampling began. Vegetation (with the exception of trees > 10 cm diameter) and leaf litter were removed simultaneously from all four sides, starting at the perimeter and working inward.

Table 1: Description of the ten sampling quadrats with the represented number of amphibian and reptile species each.

Quadrat no.	altitude m a.s.l.	short description	sampling date	no. of amphib. species	no. of reptile species
1	1200	forest between camp and plantation	25-11-98	8	0
2	1200	ecocline: forest to plantation	26-11-98	6	2
3	1600	sunpatch, montane forest	27-11-98	1	0
4	1600	ecocline: fern meadow to montane forest	28-11-98	0	2
5	700	Eyimba, secondary forest	30-11-98	6	0
6	700	Eyimba ecocline: sec. forest to plantation	1-12-98	6	1
7	1200	forest on creek side	2-12-98	10	1
8	1200	forest on creek side	3-12-98	5	0
9	1200	hilltop, tree island in plantation	4-12-98	0	0
10	1200	forest	5-12-98	3	0

Results and Discussion

Hand capture

Although not quantitative, this is a very successful method. Generally hand capture is often the most effective method of accumulating the most species in the minimum amount of time (Scott 1994). This technique resulted in a total of 40 amphibian species in five families and 41 reptile species in 13 families.

Glue traps

Despite precipitation the glue traps maintained their stickiness throughout the duration of the study. However they proved to be largely ineffective, catching a total of only four lizards (*Agama* and *Mabuya*), all found within the sunny plantation area. Insects were often represented as well as feathers of several bird species and one live bat.

Drift fence-pitfall traps

Drift fences with pitfall traps have been used successfully to determine species richness and to detect the presence of rare species (Corn 1994). Here this method proved marginally effective, producing one snake (*Natriciteres*), two lizards (*Panaspis*) and six frogs (*Arthroleptis*, *Phrynobatrachus*). A limitation of this method is that such traps tend to capture some species more readily than others (Corn 1994). Parris et al. (1999) found drift fence-pitfall traps much less effective than stream-searching during their amphibian survey in Queensland, Australia.

Table 2: Number of specimens of amphibians and reptiles found in the 10 sampling quadrats. Uncertain species determination (cf.) is indicated by °, juveniles are indicated by *.

	1	2	3	4	5	6	7	8	9	10
Amphibia	**13**	**23**	**4**	**0**	**24**	**21**	**38**	**11**	**0**	**6**
Bufonidae	1	1	0	0	8	6	6	0	0	0
Nectophryne afra						5				
Nectophryne batesi		1			8*	1				
Wolterstorffina parvipalmata	1						6			
Arthroleptidae	4	17	4	0	13	10	17	5	0	2
Arthroleptis adelphus	1					3				
Arthroleptis cf. *adolfifriderici*			4							
Arthroleptis bivittatus		1*			2					
Arthroleptis poecilinotus		1*			6	5				
Arthroleptis variabilis	2				1					
Arthroleptis sp.		15*			4*	2	12*	2*		
Astylosternus diadematus										1
Astylosternus montanus							2			1
Cardioglossa melanogaster								1		
Leptodactylodon bamilekianus							1			
Leptodactylodon mertensi	1						2	2		
Ranidae	3	0	0	0	0	0	13	6	0	4
Dimorphognathus africanus								2		
Petropedates parkeri							1			
Phrynobatrachus cricogaster							1			
Phrynobatrachus werneri	1°						7	4		4
Phrynobatrachus sp.	2									
Phrynodon sandersoni							4			
Hyperoliidae	5	5	0	0	3	5	2	0	0	0
Hyperolius ocellatus		1*								
Leptopelis brevirostris	4									
Leptopelis calcaratus	1*	4*			3*	5*	2			
Reptilia	**0**	**2**	**0**	**8**	**0**	**1**	**3**	**0**	**0**	**0**
Chamaeleonidae	0	1	0	0	0	0	0	0	0	0
Chamaeleo montium		1								
Scincidae	0	0	0	7	0	1	3	0	0	0
Panaspis amieti							3			
Panaspis reichenowii						1				
Panaspis vigintiserierum				7						
Colubridae	0	1	0	1	0	0	0	0	0	0
Chamaelycus fasciatus				1						
Lycophidion laterale		1								

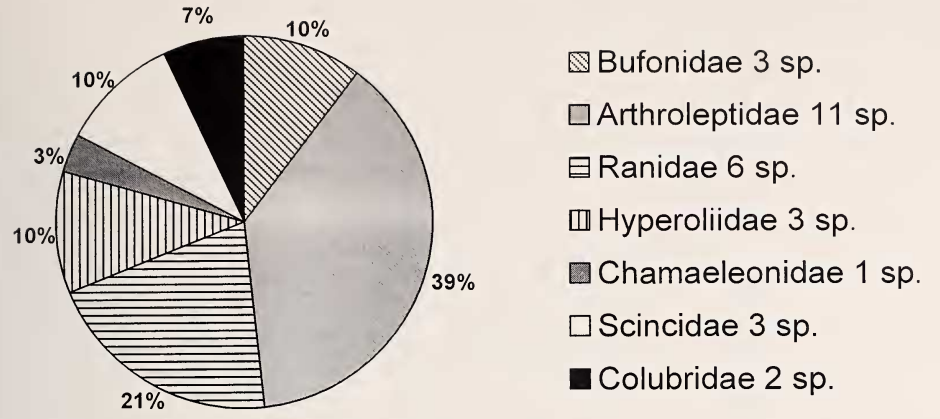

Fig.2: Herpetofauna diversity of all quadrats arranged in families

They found only two species using the traps versus 13 species by stream-searching. Both trapped species were ground-dwellers whereas a high percentage of the species recorded while stream-searching were tree frogs. Additionally, 20 shrews and rodents were also captured in the Mt Nlonako study as well as some terrestrial crabs.

Quadrat sampling

This quantitative method proved to be effective especially for the sampling of leaf litter- and ground-dwelling species (tables 1 and 2). Quadrat sampling yielded 23 amphibian species in four families, whereas hand captures, for comparison, produced 40 species in five families. Fifty-eight percent of the hand captured amphibian species were found in the quadrats. Only 15% of the hand captured reptile species (41 species from 13 families) were represented in the quadrats (six species in three families).

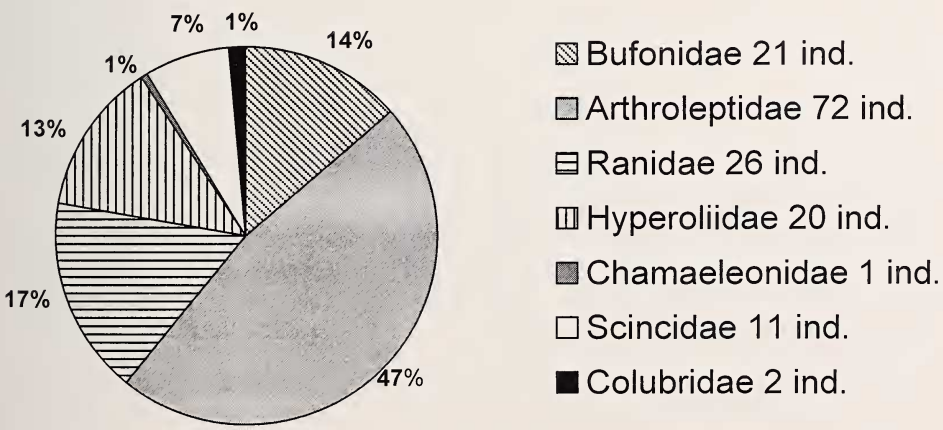

Fig.3: Relative abundance in all quadrats according to family.

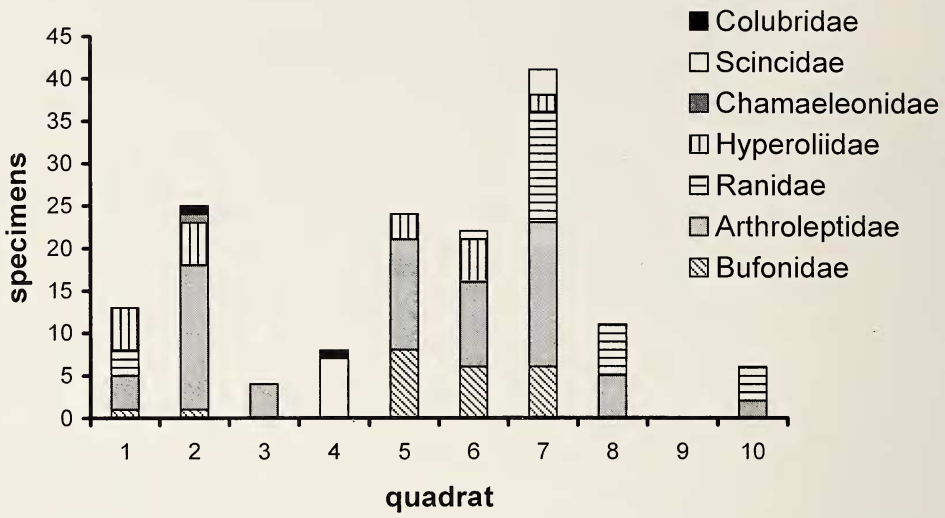

Fig.4: Diversity of amphibian and reptile species per family and quadrat.

Reptiles represented 20% of all herpetological species (fig.2) found in the quadrats and nine percent of all herpetological specimens (fig.3). Quadrat four (1600 m elevation) contained reptiles but no amphibians (table 2, fig.4 and 5). This can be related to the fact that there was no running or open water at this altitude, thus restricting amphibians dependent upon such water for reproduction. Quadrat 3 (1600 m elevation), however, contained four specimens of *Arthroleptis* cf. *adolfifriderci*. This species does not require water bodies for reproduction because it lays its eggs in moist substrate (Duellman & Trueb 1986). A similar case is reported from America, where *Eleutherodactylus*, which also undergoes a development independent of free water, may even ecologically replace small lizards (Scott 1976a). Accordingly, Inger (1980) reports that in South-east Asia and Central America floor-dwelling species of frogs and lizards in tropical forests are ecologically very similar. Quadrats 3 and 4 are characterized by low species diversity and low specimen abundance (fig.4 and 5).

Arthroleptidae and Ranidae accounted for 60% of all species (fig.2) and 64% of all reported specimens (fig.3). Arthroleptid specimens represented almost half (47%) of all specimens found and were present in eight out of ten plots.

Interestingly, hyperoliids were found only in quadrats where bufonids were present as well (figs.4 and 5). The reason may be that all reported toads were at least partially arboreal species and thus somewhat similar to treefrogs in their habitat requirements.

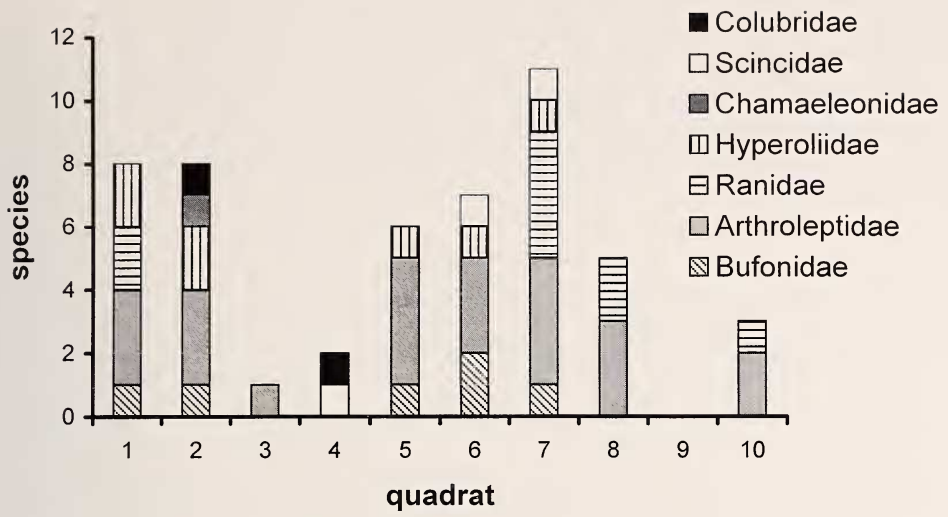

Fig.5: Abundance of individuals per family and quadrat.

Quadrat 7 had the highest species diversity and specimen abundance (figs.4 and 5). This can be explained by its position at a creek and its possibly higher microhabitat diversity. However, such an explanation may be wrong since quadrat 8, an apparently similar plot, produced only average diversity and less than average abundance values.

In general, quadrats varied greatly with regard to species diversity and specimen abundance. Thus conclusions drawn from statistical analysis of results obtained by the quadrat method will show significant trends only when larger numbers of quadrats are investigated (at least 50 quadrats; Jaeger & Inger 1994).

The lack of animals in quadrat 9 can only be explained by variation within the samples.

Scott (1976b) found a total of eight species of three amphibian families (Bufonidae, Arthroleptidae, Ranidae) in 15 rainforest plots in the Cameroon lowland (up to 30 m elevation). Quadrat size was 58 m^2. Specimens of Arthroleptidae greatly outnumbered Bufonidae and Ranidae.

In the Mt Nlonako study a total of 24.1 specimens/100 m^2 were found; amphibians with 21.9 and reptiles with 2.2 specimens/100 m^2. Scott (1976b) noted 9.4 individuals/100 m^2 in his Cameroon lowland rainforest study area. He reports 1.5 specimens/100 m^2 for a Bornean site, and in Central America 14.6 (Panama) and 17.1 (Costa Rica) individuals/100 m^2. This clearly means that the Mt Nlonako abundances are even higher than the Central American herpetofauna abundances studied so far.

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